Biochemistry 4425B – Proteomics and Structural biology of DNA repair

2022 Course Outline

1. Course Information

Biochemistry 4425B – Proteomics and Structural Biology of DNA repair
Winter Term 2022

Topics covered will include applications of modern analytical and biophysical techniques used in proteomics and related biochemical analyses, as well as DNA repair mechanisms

Lectures:
Tuesday, 9:30 -10:30 am
Thursday 9:30-10:30 am
Online until January 31
Synchronous Dr Lajoie,

Course delivery with respect to the COVID-19 pandemic

Although the intent is for this course to be delivered in-person, the changing COVID-19 landscape may necessitate some or all of the course to be delivered online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will not change. Any assessments affected will be conducted online as determined by the course instructor.

When deemed necessary, tests and examinations in this course will be conducted using a remote proctoring service. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide personal information (including some biometric data) and the session will be recorded. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western’s Remote Proctoring website at: https://remoteproctoring.uwo.ca.

If online after January 31 the lectures will be online synchronously for Dr Lajoie and Gupta and asynchronously for Dr Ling
(No laboratories and tutorials)

**Prerequisites:**
Prerequisite(s): Biochemistry 4420A

**Senate regulation regarding the student’s responsibility regarding requisites:**
Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

*Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.*
2. Instructor Information

<table>
<thead>
<tr>
<th>Instructor</th>
<th>Location</th>
<th>E-mail</th>
<th>Office Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Gilles Lajoie</td>
<td>Siebens Drake Research Institute</td>
<td><a href="mailto:glajoie@uwo.ca">glajoie@uwo.ca</a></td>
<td>By appointment (email or in-class)</td>
</tr>
<tr>
<td>(Course Coordinator)</td>
<td>Rm G31C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr. Madhulika Gupta</td>
<td>Children's Health Research Institute</td>
<td><a href="mailto:mbgupta@uwo.ca">mbgupta@uwo.ca</a></td>
<td>By appointment (email or in-class)</td>
</tr>
<tr>
<td>Dr Hong Ling</td>
<td>Medical Sciences Building Rm 334</td>
<td><a href="mailto:hling4@uwo.ca">hling4@uwo.ca</a></td>
<td>By appointment (email or in-class)</td>
</tr>
<tr>
<td>Owen Hovey</td>
<td>Siebens Drake Research Institute</td>
<td><a href="mailto:ohovey@uwo.ca">ohovey@uwo.ca</a></td>
<td>By appointment (email or in-class)</td>
</tr>
<tr>
<td>(Teaching Assistant)</td>
<td>Rm 35A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OWL: This course will use OWL for communication and distribution of teaching materials including lecture notes. Students with OWL issues should see: https://owl.uwo.ca/portal/site/owldocs

3. Course Syllabus

Biochemistry 4425B will build on Biochemistry 3381A and 4420A to cover selected topics in the areas of biological mass spectrometry, proteomics, targeted proteomics and precision medicine as well as DNA repair mechanisms in terms of structure and function.

Note: The course will start on January 11 and will be online until at least January 31.

Course Topics:

I) Biological Mass Spectrometry and Proteomics (Dr. Gilles Lajoie)
(10 lectures, January 11- February 10)
- Principles of mass spectrometry
- Design and functions of modern mass spectrometers
- Deconvolution and mass of intact proteins and complexes
- Tandem MS and sequence identification
- Identification of post-translational modifications
- Large scale proteomics experiments
- Quantitation by mass spectrometry
- Protein-protein interactions (cross-linking)

Note: Feb 19-27 (reading week- no lecture)

II) Targeted and Clinical Proteomics (Dr. Madhulika Gupta)
(6 lectures, February 15, 17, March 1, 3, 8, 10)
- An overview of targeted and clinical proteomics and respective technologies.
- Basic concepts of discovery proteomics vs targeted proteomics (MRM-MS and PRM-MS) in clinical proteomics field.
- Workflow- types and technology platforms/ assays for quantitative proteomics using complex biological/clinical samples.
- Plasma proteome complexity and challenges of analyzing and identifying novel proteins in plasma using MS based approaches for biomarker discovery
- Biomarker discovery - validation of targets and functional proteomic technology utilized for drug discovery/therapeutics with translational outcome “Bench to Bedside”.
- Case study/ mechanistic study using cell culture model/s

(III) Structural biology in DNA damage and replication (Dr. Hong Ling)
(8 lectures, March 15, 17, 22, 24, 29, 31, April 5, 7)
- Discovery of new DNA polymerases
- Structural analysis of high- and low-fidelity DNA polymerases by X-ray crystallography
- Macromolecular structure inspection and analysis
- Molecular basis of DNA damage induced mutagenesis

4. Learning Outcomes
After taking this course a student will be able to:
1. Identify the types of mass spectrometers used in proteomics and explain the principles by which these instruments work.
2. Design experiments incorporating mass spectrometry to answer large-scale questions in proteomics.
3. Understand the principle of modular domain-mediated protein-protein interactions and apply this principle to decipher the functional proteome by mass spectrometry and complementary approaches.
4. Learn the basic principles of proteomics, and the methodologies that play an important role to study very complex proteome of any organism and their application for biomarker identification, as well as their applications in both research and therapeutic/ medical diagnostic settings.
5. Design experiments for new enzyme identification, evaluate the quality of a structure from literature and inspect a macromolecule structure deposited at the protein data bank (PDB)
6. Understand structure-function relationships in different DNA polymerases and the molecular mechanisms of DNA damage induced mutagenesis

5. Course Materials
There is no required textbook for the course. All the lecture notes and additional reading materials specified by the instructors will be made available through the Biochemistry 4425B OWL site.

6. Evaluation

<table>
<thead>
<tr>
<th>Task</th>
<th>Material Covered</th>
<th>Date</th>
<th>% of Final Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment #1</td>
<td>Lajoie section</td>
<td>January 27</td>
<td>5</td>
</tr>
<tr>
<td>Assignment #2</td>
<td>Lajoie section</td>
<td>February 2</td>
<td>5</td>
</tr>
<tr>
<td>Mid-term test</td>
<td>Lajoie section</td>
<td>March 1 6:30-8:30pm</td>
<td>30</td>
</tr>
<tr>
<td>Assignment #3</td>
<td>Gupta section</td>
<td>March 8</td>
<td>10</td>
</tr>
<tr>
<td>Assignment #4</td>
<td>Ling section</td>
<td>March 30</td>
<td>10</td>
</tr>
<tr>
<td>Assignment #5</td>
<td>Ling section</td>
<td>April 1</td>
<td>10</td>
</tr>
<tr>
<td>Final exam</td>
<td>Gupta, Ling sections</td>
<td>TBA</td>
<td>30</td>
</tr>
</tbody>
</table>

**Rounding of marks:**
Final grades in this course will be rounded to the nearest integer (e.g., 73.5 becomes 74, while 73.4 becomes 73). Marks WILL NOT be bumped to the next grade or GPA level (e.g., a 79 will NOT be bumped up to an 80). The mark attained is the mark you achieved and the mark assigned; requests for mark bumping will be denied, in accordance with Bachelor of Medical Science Undergraduate Education policy.
7. Additional Information

Use of Electronic Devices
Except for simple calculators, electronic devices will not be allowed during test and examination.

Statement on Academic Offences
Scholastic offenses are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offense, at the following website: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

All required assignments may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All assignments submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (http://www.turnitin.com)

Computer-marked multiple-choice tests and/or exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

Absence from Course Commitments

A. Absence for medical illness:
Students must familiarize themselves with the Policy on Accommodation for Medical Illness for Undergraduate Students, located at:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf

Statement from the Academic Counseling Office, Faculty of Science
If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to the Academic Counselling Office as soon as possible and contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved by the Academic Counselling Office and the instructor has been informed. In the event of a missed final exam, a "Recommendation of Special Examination" form must be obtained from the Academic Counselling Office immediately. For further information please see:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf

A student requiring academic accommodation due to illness, should use the Student Medical Certificate when visiting an off-campus medical facility or request a Record's Release Form (located in the Dean's Office) for visits to Student Health Services. The form can be found at:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

B. Absence for non-medical reasons:
If you have course timetable conflicts with the test/examination times, contact the course coordinator at least two weeks before the test/examination. Components of the course evaluation
that cannot be completed on the due date because of non-medical reasons must be completed at an alternate date. In the case of assignments, if solutions have already been provided to the class, and therefore the assignment cannot be completed, the other components of the section will be more heavily weighted to absorb the missing evaluation.

Students who are in emotional/mental distress should refer to Mental Health@Western http://www.uwo.ca/uwocom/mentalhealth/ for a complete list of options about how to obtain help.

C. Special Examinations
A Special Examination is any examination other than the regular final examination, and it may be offered only with the permission of the Dean/Academic Counselling Office of the Faculty in which the student is registered, in consultation with the instructor and Department Chair. Permission to write a Special Examination may be given on the basis of compassionate or medical grounds with appropriate supporting documents.

A Special Examination must be written at the University or an Affiliated University College no later than 30 days after the end of the examination period involved. To accommodate unusual circumstances, a date later than this may be arranged at the time permission is first given by the Dean/Academic Counselling Office of the Faculty. The Dean/Academic Counselling Office will consult with the instructor and Department Chair and, if a later date is arranged, will communicate this to the Office of the Registrar.

If a student fails to write a scheduled Special Examination, permission to write another Special Examination will be granted only with the permission of the Dean/Academic Counselling Office in exceptional circumstances and with appropriate supporting documents. In such a case, the date of this Special Examination normally will be the scheduled date for the final exam the next time the course is offered.

When a grade of Special (SPC) or Incomplete (INC) appears on a student's record, the notations will be removed and replaced by a substantive grade as soon as the grade is available.

Support Services:
Registrarial Services: http://www.registrar.uwo.ca

Academic Counselling (Science and Basic Medical Sciences): http://www.uwo.ca/sci/undergrad/academic_counselling/index.html

USC Student Support Services: http://westernusc.ca/services/

Student Development Services: http://www.sdc.uwo.ca

Student Health Services: http://www.shs.uwo.ca/

Students who are in emotional/mental distress should refer to Mental Health@Western http://www.uwo.ca/uwocom/mentalhealth/ for a complete list of options about how to obtain help.